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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/658,193	09/08/2000	Takayuki Niuya	08038.0032	2409

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EXAMINER
MALDONADO, JULIO J

ART UNIT	PAPER NUMBER
2823	

DATE MAILED: 05/13/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/658,193	Applicant(s) NIUYA ET AL.	
	Examiner Julio J. Maldonado	Art Unit 2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *24 April 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *11-21* is/are pending in the application.

4a) Of the above claim(s) *17-19* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *11-16,20 and 21* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *6* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Election/Restrictions

1. Applicant's election without traverse of claims 11-16 and 20-21 in Paper No. 12 is acknowledged.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1 and 14 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. In reference to claims 1 and 14, the applicant claims "...polishing the substrate to remove a part of the wiring metal..." and "...forming on the surface of the substrate a second insulating film...", but according to Fig.2A, the metal wiring layer and the barrier layer are the materials polished, not the substrate as claimed. In reference to claim 14, the applicant claims "...the protection film is stannous chloride, stannous borofluoride, stannous sulfate, nickel chloride or nickel sulfaminate..." but according to the specification the above-mentioned materials are used to form the protection film, they are not the protection film. The above-mentioned materials are dissolved in a solution and the metallic ions in such solution are deposited on the surface of the copper layer, thus forming a metal layer. Therefore the protection film is a metal layer not a salt (see page 11, lines 22-26). Also, claim 14 teach

"...applying a solution of an organic substance to be bound to the first metal layer onto the surface of the substrate to form on a surface of the first metal layer a protective film for preventing metal diffusion; wherein the protection film is stannous chloride, stannous borofluoride, stannous sulfate, nickel chloride, or nickel sulfaminate...". If the substance is organic by nature, why does the applicant claim that the protection film materials comprise inorganic substances? According to Avanzino et al. (U.S. 6,350,687), one way to prevent copper diffusion is to form an organic layer and another way is to form a metallic layer. Is claim 14 claiming two different embodiments?

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

5. Claims 11, 13, 15 and 16 are rejected under 35 U.S.C. 102(e) as being anticipated by Obeng et al. (U.S. 6,323,131).

In reference to claims 11, 13 and 15, Obeng et al. (Fig.1) in a related method to form copper damascenes teach the steps of making a first concavity (16) in a first insulating film (10) on a surface of a substrate (12); burying the first concavity (16) with a first barrier layer (18) for preventing metal diffusion with a wiring metal (20) comprising copper; polishing the substrate (12) to remove a part of the wiring metal (20) residing higher than the upper peripheral level of the first concavity (16) so as to leave a first metal layer (22) in the first concavity (16); applying a solution of an organic substance tending to be bound to the first metal layer (22) for preventing metal diffusion, said organic compound comprising an alkanolamine; forming on the surface of the substrate (12) a second insulating film (Fig.1d, 10) directly connected to the first metal layer (22); making a second concavity (Fig.1d) in the second insulating film (Fig.1d, 10) in a region above the first metal layer (22); and burying the second concavity covered with a second barrier layer (Fig.1d, 18) with a second wiring metal layer (Fig.1d, 20) to be connected to the first metal layer (22) (column 2, line 50, column 4, line 35).

In reference to claim 16, Obeng et al. teach washing the polished substrate (12) to remove the metal (20) residing higher than the upper peripheral level of the first concavity (16) to leave the first metal layer (22) in the first concavity (16) (column 2, line 50, column 4, line 35).

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Obeng et al. ('131) in view of Avanzino et al. (U.S. 6,350,687).

In reference to claim 12, Obeng et al. substantially teach all aspects of the invention but fail to show the organic substance is a triazole compound. Nevertheless, Avanzino et al. (Fig.1-5) in a related method to form a protective layer to a copper damascene teach forming a protective layer over a copper damascene, said protective layer comprising a triazole compound (column 5, line 11 – column 7, line 39). Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention was made to form the protective layer of the triazole compound as taught by Avanzino et al. on the surface of the first metal layer of Obeng et al., since by doing so it would prevent the formation of a thick oxide layer from the surface of the copper layer (column 5, lines 1-16).

8. Claims 14, 20 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Obeng et al. ('131) in view of Avanzino et al. ('687) and Endo et al. (U.S. 5,795,828).

In reference to claims 14 and 20, Obeng et al. (Fig.1) in a related method to form copper damascenes teach the steps of making a first concavity (16) in a first insulating film (10) on a surface of a substrate (12); burying the first concavity (16) with a first barrier layer (18) for preventing metal diffusion with a wiring metal (20) comprising copper; polishing the substrate (12) to remove a part of the wiring metal (20) residing higher than the upper peripheral level of the first concavity (16) so as to leave a first

metal layer (22) in the first concavity (16); applying a solution of an organic substance tending to be bound to the first metal layer (22) onto the surface of the substrate (12) to form on a surface on the first metal layer a protective film for preventing metal diffusion; forming on the surface of the substrate (12) a second insulating film (Fig.1d, 10) directly connected to the first metal layer (22); making a second concavity (Fig.1d) in the second insulating film (Fig.1d, 10) in a region above the first metal layer (22); and burying the second concavity covered with a second barrier layer (Fig.1d, 18) with a second wiring metal layer (Fig.1d, 20) to be connected to the first metal layer (22) (column 2, line 50, column 4, line 35).

Obeng et al. fail to teach the protection film is a metal layer, said metal layer is electroless plating deposited by using a salt of stannous chloride, stannous borofluoride, stannous sulfate, nickel chloride, or nickel sulfaminate. Nevertheless, Avanzino et al. (Fig.1-5) in a related method to form protective film on a copper damascene teach treating the surface of the copper layer with a metal protective film deposited by electroless plating. Therefore, it would have been obvious to one of ordinary skill in the art at the of the invention was made to form a metal layer over the copper damascene as taught by Avanzino et al. in the copper damascene of Obeng et al., since the formation of a thick oxide layer over the copper layer is prevented by such treatment (column 5, lines 1-16).

Obeng et al. in combination with Avanzino fail to teach using stannous chloride, stannous borofluoride, stannous sulfate, nickel chloride, or nickel sulfaminate to form the protection film. However, Endo et al. in a related method to form damascene teach

forming a metal layer using stannous chloride, stannous borofluoride, stannous sulfate, nickel chloride, or nickel sulfaminate by electroless plating (column 4, lines 43-49). Therefore, it would have been obvious to one of ordinary skill in the art to use the nickel chloride as taught by Endo et al. in the combination of Obeng et al. and Avanzino et al., since nickel chloride is well-known material used for the deposition of metallic nickel by electroless plating (column 4, lines 20-56).

In reference to claim 21, Obeng et al. teach washing the polished substrate (12) to remove the metal (20) residing higher than the upper peripheral level of the first concavity (16) to leave the first metal layer (22) in the first concavity (16) (column 2, line 50, column 4, line 35).

Conclusion

9. Papers related to this application may be submitted directly to Art Unit 2823 by facsimile transmission. Papers should be faxed to Art Unit 2823 via the Art Unit 2823 Fax Center located in Crystal Plaza 4, room 3C23. The faxing of such papers must conform to the notice published in the Official Gazette, 1096 OG 30 (15 November 1989). The Art Unit 2823 Fax Center number is **(703) 305-3432** . The Art Unit 2823 Fax Center is to be used only for papers related to Art Unit 2823 applications.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Julio J. Maldonado** at **(703) 306-0098** and between the hours of 8:00 AM to 4:00 PM (Eastern Standard Time) Monday through Friday or by e-mail via julio.maldonado@uspto.gov. If attempts to reach the examiner by telephone

are unsuccessful, the examiner's supervisor, Wael Fahmy, can be reached on (703) 308-4918.

Any inquiry of a general nature or relating to the status of this application should be directed to the **Group 2800 Receptionist** at **(703) 308-0956**.

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